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ABSTRACT

Individualized biology activities for secondary students are presented in this teaching guide. The guide is divided into five sections: (1) investigating bread mold; (2) investigating transpiration; (3) completing a botany project; (4) collecting, preserving, and identifying leaves; and (5) writing up science laboratory investigations. The sections on bread mold, transpiration, and leaves include teacher's guides and students' pages. The students' pages contain activities requiring reading, writing, research, experiments, and drawing. The teacher's guides include student objectives, lists of materials needed, optional activities, and answers to quizzes and questions. Suggestions and instructions for both the teacher and the students are given for the nine-week botany projects and for the science laboratory write-ups. The write-ups are required of students who wish to conduct independent investigations. This document is part of a collection of materials from the Iowa Area Education Agency 7 Teacher Center project. (EM)

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# Mostly Plants

INDIVIDUALIZED BIOLOGY

ACTIVITIES ON:

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I. INVESTIGATING BREAD MOLD
II. TRANSPIRATION
III. BOTANY PROJECT
IV. COLLECTING/PRESERVING/IDENTIFYING LEAVES
V. STUDENT SCIENCE LABORATORY WRITE-UPS

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SE044149

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Author(s): Paul R. Gibson

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Teacher Center Policy Board Chair - Doris Mauer
Teacher Center Director - Diane Gibson, Ed. D.

Ronald Dickinson, Ed. D.- Chief Administrator, AEA 7

# A MOLDY PROBLEM:

## Investigating Bread Mold

TEACHER'S GUIDE: A Moldy Problem (Investigating Bread Mold)

OBJECTIVES:

After completing this activity, the student should be able to:

1) Prepare bread mold culture.

2) Define photosynthesis.

3) Explain the difference between saprophytes and parasites.

4) Identify the following bread mold structures under the dissecting microscope:

   a) Sporangiophores
   b) Sporangia
   c) Rhizoids
   d) Stolons

5) State the function of the structures listed in #4 above.

6) Draw bread mold plants and label the parts listed in #4 above.

7) State how penicillin was discovered by Fleming.

MATERIALS

M-1: Biology reference text(s)

M-2: Bread (1 slice/student)
Petri dish
Eyedropper
Biology reference text(s)

M-3: Dissecting microscope

M-4: Library references and/or biology reference text(s)

M-5: Bread Mold Quiz Sheet

Optional Activities

I. Microscopic . . .

Compound microscope
Bread mold culture
Forceps or dissecting needles
Slide
Coverslip

II. Inhibitors

Ingredients lists from wrappers of bakery goods (students supply their own)

III. Mushrooms

Mushrooms (students will supply their own)
Razor blade
Slide
Cover slip

IV, V. Growing Other Molds

Various foods and other organic substances (students will supply their own)

VI. Take a Hike

No supplies needed

VII. Research

Library references

ANSWERS:

M-1: Sentences about slime molds will vary.
Classification lists in margin:

Kingdom
Phylum
Class
Order
Family
Genus
Species

M-2: Photosynthesis: This is a process in which light and chlrophyll are used by the plant to make carbohydrates out of water and carbon dioxide.

Saprophyte: An organism (in this case, a plant) that absorbs food from decaying organic matter is a sprophyte.

Parasite: An organism (in this case, a plant) that feeds on other living things is called a parasite.

M-3: Sketches will vary.

M-4: Reports about Fleming will vary.

Optional Activities

I. Microscopic . . .
Drawings will vary.

II. Inhibitors
Reports will vary.

III. Mushrooms
Sketches will vary.

IV, V. Growing Other Molds
Experimental designs and results will vary.

VI. Take a Hike
Sketches, etc. will vary.

VII. Research
Reports should relate to the fact that fungi are decomposers.

Answers to Quiz

1. E, 2. B, 3. A, 4. B, 5. B, 6. Spores, 7. Sporangium, 8. Sporangiophore, 9. Stolon, 10. Rhizoid

NAME: _____

A MOLDY PROBLEM:
Investigating Bread Mold

INTRODUCTION

M-1: Did you know that mildew and mold are members of the Plant Kingdom? These plants are actually fungi, and are a part of a phylum that consists of about 100,000 separate species. This phylum is called the Mycophyta and includes such non-green plants as mushrooms, yeasts, rusts and smuts that attack crops, bracket fungi, puffballs, and others.

Plants making up the phylum Mycophyta are termed true fungi, as opposed to the slime molds in the phylum Myxomycophyta. Since you will not look at any slime molds in this activity, do some readings about these plants in a biology text book. In the space below write two or three sentences about slime molds.

There are four classes within the phylum Mycophyta. One of these classes is termed the Phycomycetes. In this exercise you will grow bread mold, a member of the Phycomycetes, and then examine the structure of these plants. (Mold is a general term used to refer to many kinds of fungi.)

If you are not familiar with such terms as kingdom, phylum, and class, obtain a life science and/or biology text and read about the categories of biological classification that a scientist named Linnaeus devised in the eighteenth century. List each of the categories, from the largest to most specific, in the left-hand margin.

GROWING THE MOLD

M-2: Five to seven days before you plan to investigate molds, place a piece of bread in the bottom half of a Petri dish. Try to use bread from a local bakery that has not been treated with chemicals to discourage the growth of fungus. Homemade bread works the best, if it is available. Fill an eyedropper with water and empty it over the surface of the bread. It is not necessary to drop water over the entire surface.

Leave the bread exposed tó the air for most of a class period and then cover it with the top half of the Petri dish. Put the dish in a storage place that is dark and cool for about a week.

The mold that will grow on your bread is of the genus Rhizopus. Molds do not contain chlorophyll. Therefore, they cannot carry out photosynthesis like most plants. What is photosynthesis?

Since molds cannot make their own food, they are either saprophytes or parasites. Obtain a biology reference text and find out what these two terms mean. Write the definitions below.

SAPROPHYTE:

PARASITE:

OBSERVING BREAD MOLD

M-3: When some of the bread is covered by mold, which will look something like cotton, remove the culture from the storage area. Remove the lid from the Petri dish and put the bottom half with the bread on the stage of the dissecting microscope. Focus on a mold that appears to have dark dots on top.

The "threads" that you can see within the cottony mold are called hyphae. The total cottony mass of hyphae is called a mycelium. You will note three different types of hyphae. Sporangiophores are found above the surface of the bread, rhizoids penetrate the surface, and stolons lie on top of the bread's surface.

Sporangiophores are also known as ascending hyphae since they grow upward. Small dark knobs called sporangia are supported on the ends of the sporangiophores. These are the black dots that can be seen with the naked eye. Each sporangium contains thousands of very lightweight spores. The spores are released into the air when the sporangium splits after maturing and drying out. If a spore comes to rest on a good food supply, new mycelium will be produced.

Rhizoids are called descending hyphae because they grow downward. Rhizoids look like roots and anchor the mold to the bread. Also, enzymes secreted by the rhizoids bread down (digest) substances in the bread. The digested material can be used as food by the mold plant. The odor of the moldy bread, as well as the spots of color that you see, are due to the action of the enzymes.

Stolons are called transverse hyphae because they grow across the surface. Can you see how the stolons seem to link individual plants together? Actually, the bread mold spreads along the surface of the food supply when rhizoids form at the ends of stolons that grow from individual plants. The sporangiophores then grow from the rhizoids.

Sketch several of the mold plants as observed through the dissecting microscope. Lable the sporangiophores, sporangia, rhizoids, and stolons. Make your drawing as neat and accurate as possible.

Teacher Check
Drawing OK

REPORT

M-4: Using library references (or biology texts in your classroom), write a one-page report about the accidental discovery of penicillin by Sir Alexander Fleming. Include information on the source of the early supplies of penicillin and how the penicillin is prepared by pharmaceutical companies today. Attach your report to this lab.

QUIZ

M-5: Your teacher will give you a short quiz over this lab after you review the material. Then, do any or all of the optional activities below if you wish. (They are not required.)

QUIZ SCORE: _____

OPTIONAL ACTIVITIES

I. Microscopic Examination of Bread Mold

Obtain a compound microscope. Try to remove a single bread mold plant consisting of sporangiosphores, rhizoids, and a stolon. This will be a very challenging task! Use forceps or dissecting needles to remove the plant. Carefully place the plant on a drop of water on a slide and put a cover slip over the plant. View the plant with the low power objective.

Sketch the plant below. Label the sporangiophores, sporangia, rhizoids, and stolon(s). Make your drawing as neat and accurate as possible.

Now, switch to the high power objective and focus on a sporangium. The wall of the sporangium, the spore inside, and the supporting sporangiophores should be visible. Can you find a sporangium that has split apart releasing spores? Sketch what you see and label the parts underlined above.

Have your teacher check your drawings for accuracy and neatness.

Teacher Check
Drawings OK ☐

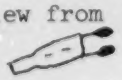
II. Inhibitors

Call or visit a commercial bakery in a metropolitan area. Find out how bakery products are treated to inhibit the growth of fungi. Cut out ingredients lists from bread wrappers, etc., and circle the names of the chemicals that you learned inhibited fungal growth. Glue or paste the lists to a sheet of paper in a neat and attractive fashion and attach this sheet to this lab along with a short report detailing the information you received from the bakery you contacted.

III. Mushrooms

If you find some mushrooms growing in your lawn or in a wooded area while you are working on this lab, bring two specimens to the classroom. Do this carefully so that the mushrooms are not damaged.

Sketch one of the plants and label the following parts: stripe (stalk), cap (the umbrella-shaped top), and gills (structures beneath the cap).

Now break off a small piece of a gill. Using a razor blade, cut off a single thin piece of the gill that is dark in color. Do not crush this piece in your fingers! Handle with care. Place the gill section on a drop of water on a slide. Place the slide under a compound microscope. View the gill under high power. Attached to the gill are many slender basidia. Each basidium bears four spores. The spores look like small, dark circles. If basidium with spores is viewed from the top, you will only see the spores: If you find a basidium that you can view from the side, the basidium and spores will look something like this:  Spores in clusters of four will not be hard to locate, but you may need to search rather extensively across the slide for a basidium that can be viewed from the side. When you find the spore clusters, as well as a basidium that can be viewed from the side rather than from the top, point them out to your teacher.

Teacher Check
I.D. Ck

IV, V: Growing Other Molds

Molds can grow on almost every kind of food. In fact, molds of different types can grow in nearly every organic substance under the right conditions. What is an organic substance?

Design an investigation do determine the conditions under which mold will grow on substances other than bread. You might try meat, fruits, vegetables, and organic substances other than food. Talk to your instructor about your experimental design before you actually carry out the investigation. Then, present the data you collect in well-organized tables, as appropriate. Also, write a short report detailing your observations and conclusions. Attach these separate sheets to this lab.

This special activity counts as 2 optionals.

VI. Take a Hike

Read about other members of the Mycophyta that can be found in nature. Then go to a wooded area and look for examples of these types of fungi. Sketch each type you find. Below each drawing indicate the common name of the fungi and where in the woods you observed it.

Whenever you go hiking, you should <u>leave</u> nothing but footprints and <u>take</u> nothing but pictures.

VII. Research

Every plant and animal in existence is part of a food chain. The fungi are no exception. Do some research concerning the role of fungi in food chains and attach a brief report to this lab.

BREAD MOLD LAB

QUIZ

_____ 1. The phylum Mycophyta contains

a) non-green plants
b) about 75,000 separate species
c) bread mold
d) mushrooms
e) all of the above

_____ 2. What is the proper formula for photosynthesis?

a) $C_6H_{12}O_6 + O_2 \xrightarrow[\text{chlorophyll}]{\text{light}} CO_2 + H_2O$

b) $CO_2 + H_2O \xrightarrow[\text{chlorophyll}]{\text{light}} C_6H_{12}O_6 + O_2$

c) $C_6H_{12}O_6 + CO_2 \xrightarrow[\text{chlorophyll}]{\text{light}} H_2O + O_2$

d) $H_2O + O_2 \xrightarrow[\text{chlorophyll}]{\text{light}} C_6H_{12}O_6 + CO_2$

_____ 3. Hookworms, or Nematodes, attach themselves to the mucosal lining in the gut of a host. The hookworm is an example of a

a) parasite
b) saprophyte
c) fungi
d) hyphae

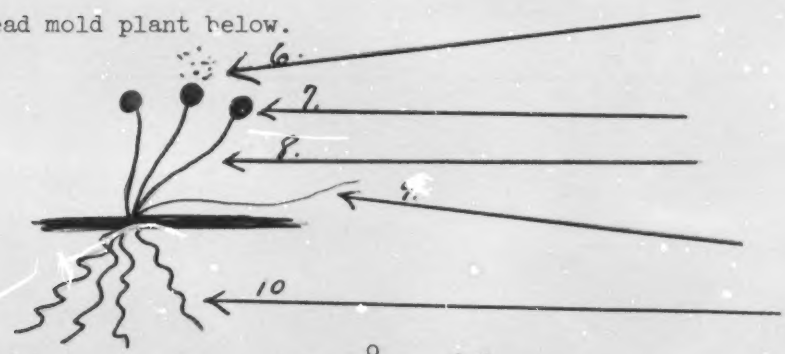
_____ 4. Mold grew on the moistened bread because a _____ landed there.

a) mycelium
b) sporangium
c) rhizoid
d) hyphae

_____ 5. Descending hyphae are called

a) sporangiophores
b) rhizoids
c) stolons
d) sporangia

Label the bread mold plant below.



# TRANSPIRATION

TEACHER'S GUIDE: Transpiration

OBJECTIVES:

After completing this exercise, the student should be able to:

1) Diagram and label the hydrologic cycle.
2) State a summary of the hydrologic cycle.
3) Define transpriation.
4) Draw and label guard cells and stomates.
5) Prepare a data table.
6) Define diffusion.

MATERIALS:

T-1: Biology reference text(s)
T-2: Biology reference text(s)
T-4: Biology reference text(s)
T-6: Centimetre interval ruler

ANSWERS:

T-1: Approximately 75%; $H_2O$

T-2: Diagrams will vary, but check for thoroughness and neatness.

T-3: Summaries will vary. A sample answer might be as follows:

> Water vapor is released into the air through transpiration. Water is also put into the atmosphere from land and particularly from bodies of water such as streams, rivers, lakes, and oceans by the process of evaporation. Water vapor in the atmosphere condenses on particulate matter and eventually falls as precipitation. Precipitation may run off into streams, which flow into rivers and ultimately to lakes and oceans. Or, precipitation may enter the soil through infiltration, where it can be taken up by the roots of plants, seep into lakes and streams, or surface through wells or springs.

T-4: Diagrams will vary.

T-5: Data tables should include a title and appropriate column headings.

T-6: Drawing of 1 $cm^2$.

T-7: No; stomates are extremely small in size.

T-8: Higher; lower

T-9: Guard cells retain water within the plant and thus reduce water loss.

T-10: A constant supply of water is available to plants such as the bulrush that grow in very wet environments, so regulation of water loss is not necessary.

NAME: _____

TRANSPIRATION

Introduction: The Water Cycle

T-1: The most abundant material in living cells is water. Most cells average 65% to 75% water. Obviously, living organisms would not be able to survive without abundant supplies of fresh water. Fortunately, water is a major constituent of the land, or lithosphere, and the air, or atmosphere. Obtain a reference text and discover what percent of our world is covered by water.

What is the empirical formual for water? _____

T-2: The water portion of our earth is referred to as the hydrosphere. The components of the hydrosphere are connected in a cycle that functions in moving and conserving water in our environment. Find two or three diagrams of this global cycle, and then draw and label your own representation of the hydrologic cycle below. Be as complete and neat as possible.

T-3: Now, summarize in writing the hydrologic cycle. Write complete sentences!

Transpiration

T-4: As a result of investigating the water cycle, you should have found that water vapor is released into the air by plants through transpiration. This process is fascinating, and the remainder of this exercise will examine transpiration in some detail.

The structures of plants most intimately involved in transpiration are the guard cells and stomates located on the surface of leaves. (The term stomate is derived from the Greek word "stoms", meaning mouth.) These pores allow gases to be exchanged between cells within the leaf and the atmossphere. Almost any biology reference text will contain one or more illustrations of stomates and guard cells. Locate such a reference and draw both an open and closed stomata. Label the guard cells and other leaf structures as appropriate.

| Open Stomata | Closed Stomata |
|---|---|

T-5: The epidermis is a continuous cell layer that envelops the plant. Stomates and guard cells may be located within the upper or lower epidermal layers, or both, depending on the species. The average number of stomates per square centimetre of surface for an apple leaf is about 30,000 for the lower epidermis, while none are located on the upper epidermis. A corn leaf has about 5,000 stomates per square centimetre on the upper epidermis and nearly 7,000/$cm^2$ on the lower epidermis. A bean leaf has 4,000 stomates/$cm^2$ on the upper epidermis and over 28,000 on the lower epidermis. A red oak tree leaf possesses no stomates on the upper epidermis and about 68,000 on the lower epidermis.

Devise a data table in the space provided that will present information listed above in an orderly fashion.

T-6: To gain an appreciation of the data presented in the table above, obtain a ruler marked in centimetres and draw one square centimetre below. Label your drawing "1 $cm^2$."

T-7: We have discovered that a leaf from a red oak tree has about 68,000 openings per square centimetre on its lower surface. If you were to take a straight pin and attempt to make this many tiny holes in the square centimetre you drew in T-6, do you think you would be successful? _____

What does this tell you about the size of stomates?

T-8: The process of diffusion involves the movement of a substance from a region of high concentration to a region of lower concentration. This principle can be applied to transpiration. Air contains less water than leaf cells do, so water molecules move from a region of (higher, lower) concentration in the leaf cells to reagion of (higher, lower) concentration in the atmosphere. (Underline the appropriate responses.)

T-9: If too much water was lost through stomates, the plant would not be able to survive. So, plants have adapted to prevent excessive water loss. Refer to the drawing you made in T-4. You should have labeled the guard cells, which have thick inner walls that bend outward when the guard cells swell with water. The stomate is then opened. When the water content decreases, the guard cells lose some of their rigidity and the stomata closes. What function do the closed stomata serve?

T-10: Bulrushes are grasslike plants that grow in very wet environments. Propose a reason why the stomata of bulrushes never close.

T-11: Check with your teacher to see if any additional work or readings are required.

# BOTANY PROJECT

TEACHER'S GUIDE: Botany Project

This assignment will allow students to pursue research and activities related to plants, and works quite well as a fourth nine weeks project. Hand out the assignment sheet early in the quarter, and fill in the DUE DATE section before duplicating the master. Also, space is provided for additional directions.

I. RESEARCH

Fill in the number of pages you wish the students to write before duplicating the master.

As appropriate, you may wish to waive the typing requirement.

Bibliography forms are from a text on term paper writing, so they should be acceptable.

II. OPINION

Again, you may wish to waive the typing requirement.

Source of quote:

Sinnott, Edmund. Botany: Principles and Problems. New York: M-Graw-Hill Book Co., 1946, p. 1.

III. POEM

You may wish to waive the typing requirement.

IV. IMAGINE . . .

Our brain possesses two minds: one that is rational and logical (left cerebral hemisphere), the other intuitive, metaphoric, and holistic (right cerebral hemisphere). The overwhelming emphasis in public education has been with the rational and logical hemisphere. This section of the assignment allows students to pursue activities related to the right cerebral hemisphere.

(Roy Unruh, UNI Department of Physics, researched the two hemispheres of the brain as he conpleted his doctoral dissertation. If you desire more information on this subject, write him or call his office at 273-2380.)

V. ORGANIZING YOUR PROJECT

A project evaluation form is attached.

ASSIGNING QUARTER PROJECTS:

A Word To Teachers

Why not assign a rather major project for students to complete during each nine weeks? In most cases you will be pleasantly surprised at the quality of work your students will do.

Give students the appropriate guidelines very early in the quarter so that they will have ample time to develop ideas. Every week or so, mention the importance of making a continuing effort to complete the project on time.

Here are some suggestions:

1. First Nine Weeks Project

   Your project will be due on _____. Late projects will not be accepted. The topic of your project must relate to biology in some way, and may take virtually any form except a research paper. Here are just a few of the many possible ways you may present your topic:

   - photography
   - jewelry
   - paintings
   - sculpture
   - needlepoint
   - slide presentations

   Begin thinking about the topic you wish to pursue and how you plan to present it immediately. Don't wait until the last minute! If you have questions as you work on your project, see your teacher.

2. Second Nine Weeks Project

   Your project will be due on _____. Late projects will not be accepted. Follow these guidelines:

   a. Your project must be a research paper.
   b. Your topic must be approved by your instructor and must be related to biology. Pich a subject of special interest to you.
   c. As you prepare your final draft, follow these instructions:
      1. Type your paper if at all possible.
      2. Double-space the text. Use one side of the paper only.
      3. Use at least four sources of information. List these properly at the end of your paper on a page entitled "Bibliography".
      4. Use footnotes as appropriate.
      5. The text of your paper should be the equivalent of three typewritten pages long.
      6. Your evaluation will suffer if excessive errors in spelling, grammar, and/or sentence structure appear.

d. Begin thinking about the subject you will write about immediately. Do some preliminary research on the topic. Don't wait until the last minute to begin work on your paper!

3. Third and Fourth Quarter Projects

During the second semester you may wish to assign projects related to specific topics that you have presented to the class. These assignments could become progressively more involved and challenging than the first and second nine weeks projects. An example is the Botany Project idea that follows this section.

NAME:_____

BIOLOGY

BOTANY PROJECT

This project consists of a series of items related to plants. It is important that you follow directions carefully.

Projects will be evaluated on the basis of completeness, neatness, organization, and creativity. It will be to your advantage to begin work on this project as soon as possible.

DUE DATE:

I. RESEARCH

A. Your assignment: Write a _____ page typewritten report on one of the following topics:

1) A poisonous plant
2) A medicinal plant
3) A plant that is a source of a mind-altering drug
4) An ornamental plant
5) A plant species that is endangered
6) A carnivorous plant
7) An economically useful plant

B. Follow these directions:

1) Papers must be typewritten.
2) Type on one side of the paper only. The text must be double spaced. Do not use subheadings.
3) You must use at least three sources of information. List these properly at the end of your paper on a page entitled "Bibliography." Proper forms for books, encyclopedias, and periodicals are as follows:

a. Book
Smith, John A. Principles of Botany. New York: McGraw-Hill Book Co., Inc., 1946, pp.240-260.

b. Encyclopedia
"Aardvark," Encyclopedia Britannica (1964), Vol. I, p. 1.

c. Periodical (Magazine)
Whittmer, Joe. "The Amish and The Courts," Phi Delta Kappan, LIV (September, 1972), pp.50-52.

4) Use footnotes as appropriate. You must use footnotes when you use information from a reference. You may use one of these two forms:

a. Place the footnote at the bottom of the page. Example:

Storage roots generally contain a large proportion of water, normally 80 to 90%.[1]

---

[1]Smith, p. 243

b. Place the footnote in the text of the paper. Example:

. . . normally 80 to 90%. (Smith, p. 243)

5) Proofread your paper carefully before handing it in with the rest of your project.

C. Optional Activities

1) Write a second report on one of the topics listed below. Follow the same research paper guidelines given above.

a. A disease affecting plants
b. Evidence for intelligence and sensitivity in plants
c. Lichens
d. Epiphytes

2) In addition to handing in the required research paper, you may elect to give a five or ten minute presentation to the class explaining the results of additional research. If you wish to pursue this option, please see your instructor before proceeding.

II. OPINION

Botany is the science of plant life. In one scientist's opinion, botany "is one of the fundamental sciences, for a knowledge of plants is of the utmost importance for the life of man in many ways." Write a paragraph explaining why you agree or disagree with this statement. Use examples as appropriate. Type your opinion, double spacing the text. Center your paragraph on your paper.

III. POEM

A. Look through books of poems in the library or elsewhere until you find one relating to plants. Type the poem, centering it carefully on your paper. Be sure to indicate the author of the poem.

B. Optional Activity

Draw a series of original illustrations around the margin of the centered poem. (Please do not use pencil.)

IV. IMAGINE . . .

a. Here's your chance to be creative. You may select any <u>one</u> of the following:

1. Create a collage depicting how you think a plant (or some part of a plant) "feels."
2. Imagine that you are a leaf on a tree. Describe your feelings and tell what you see in a one or two page typed paper.
3. Find a large tree in your yard or in a park. Sit down on the ground with your back resting against the trunk of the tree. Repeat the activity with a much smaller tree. Describe the sensations transmitted to you and your emotional responses to both trees in a one or two page typed paper.
4. Create a collage depicting the strength of trees.
5. Imagine yourself as a hobbit-like creature dwelling perpetually beneath the surface of the earth. Write a short story about some aspect of your life.
6. Write a poem entitled, "A Flower Is . . ."
7. Imagine that you are a nutrient molecule entering the root hair of a plant. Describe your feelings and tell what you see as you journes through the root system and ultimately into the plant itself. Prepare a one or two page typed paper.
8. Submit a one or two page typed paper telling how your life would be changed if there were no trees on earth.
9. You are a primitive plant existing in pre-historic times. In a one or two page typed paper describe your surroundings and the way you feel about your life.
10. Create a collage about "The Beauty of Flowers."
11. If you were a plant, and could speak, what would you say to mankind? Prepare a one or two page typed paper concerning this subject.
12. Create a photographic essay on a specific topic concerning plants, such as "The Birth of a Flower," "Leaves," etc.
13. Create a cartoon strip relating to the study of plants or to a topic suggested above.
14. Create a painting, drawing, or other approved art work relating to the subject of plants or to a topic suggested above.

B. Optional Activity

Select a second item from the above list and turn it in as an optional.

VI. ORGANIZING YOUR PROJECT

A. Before handing your project in, do the following:

1. Be sure you have completed all required activities in the proper manner. Follow directions!

2. Proofread all written material. Be certain that every item is neat in appearance.

3. Find a folder for project items. Place them in the following order:

   a. Title page (followed by a Table of Contents if you wish)
   b. Research paper and bibliography
   c. Opinion paragraph
   d. Poem
   e. "Imagine . . . " activity

4. Clearly indicate which activities, if any, are optionals.

B. It is very important that you prepare your entire project in a very complete, well organized, and neat fashion. Your project should be the ultimate expression of your abilities.

NAME:_____

BOTANY PROJECT EVALUATION

I. RESEARCH

_____ Topic acceptable

_____ Typewritten

_____ Proper language use

_____ sentence structure

_____ spelling

_____ grammar

_____ Used at least three references

_____ Proper bibliographical form

_____ Footnotes

☐ Optional Report

II. OPINION PARAGRAPH

_____ Typed

_____ Centered attractively

III. POEM

_____ Typed

_____ Author of poem indicated

☐ Optional Illustrations

IV. IMAGINE . . .

Item completed: 1 2 3 4 5 6 7 8 9 10 11 12 13 14

☐ Optional Item Submitted

V. ORGANIZATION

_____ Project submitted in the proper order

_____ title page

_____ research paper

_____ opinion paragraph

_____ poem

_____ "Imagine . . ." activity

COMMENTS:

Score _____

# COLLECTING/PRESERVING/IDENTIFYING LEAVES

TEACHER'S GUIDE: Collecting/Preserving/Identifying Leaves

This exercise may be incorporated into taxonomy and/or botany units. Some student familiarity with taxonomic keys would be helpful.

OBJECTIVES:

After completing this exercise, the student should be able to:

1. Collect tree leaves.
2. Press and mount the leaves.
3. Identify each specimen as to common and (hopefully) scientific names with the use of taxonomic keys.

MATERIALS:

Plant press or several books and catalogs
Construction paper
Rubber cement
Comman Name/Scientific Name labels (Master provided)
Taxonomic keys for trees and books relating to leaves.

PLANT PRESS HINTS:

You may construct your own plant press using readily available materials:

2 cords
2 sheets of ¼" or ½" plywood, approximately 30 cm x 60 cm
24 sheets of cardboard cut to above dimensions

Place the cardboard sheets between the plywood and secure with cords. Students will now be able to press and retrieve specimens as necessary.

Common Name:

Scientific Name:

Common Name:

Scientific Name:

Common Name:

Scientific Name:

Common Name:

Scientific Name:

Common Name:

Scientific Name:

Common Name:

Scientific Name:

Common Name:

Scientific Name:

Common Name:

Scientific Name:

Common Name:

Scientific Name:

Common Name:

Scientific Name:

COLLECTING/PRESERVING/IDENTIFYING LEAVES

There are about 450,000 known kings of plants, from trees to microscopic algae. All other living things depend upon plants as a direct or indirect food source. Plants are the first link in every food chain.

Botanists, scientists who study plants, routinely collect leaves (or entire plants) and preserve them by mounting them after the specimens are pressed flat. Then, identification and study of plant structures may be undertaken.

Your assignment is to collect leaves from ten different trees. Follow these directions:

1. Bring the tree leaves to class pressed flat in a book or catalog.
2. Place leaves between two sheets of newspaper. Do not overlap the leaves. Write your name on the newspaper.
3. Place the newspaper containing the leaves between two sheets of cardboard in a plant press, if one is available. If not, place the newspaper containing the leaves between stacked books or catalogs.
4. Retrieve your leaves after two or three days. Mount them immediately on construction paper with rubber cement. BE NEAT!
5. Write your name on the construction paper. Glue a "Common Name/ Scientific Name" label to the paper.
6. Complete the label as appropriate using keys and books provided by your instructor.

STUDENT SCIENCE LABORATORY WRITE-UPS

TEACHER'S GUIDE: Directions for Student Science Lab Write-Ups

OBJECTIVES:

This format was designed primarily for students who desire to conduct independent investigations.

In addition, though, these directions could be used for writing up virtually any laboratory investigation.

Even though you may not use the "DIRECTIONS" sheet during the school year, you may want to distribute a copy to each student anyway so they will gain an appreciation of what an advanced (college) lab report should contain.

DIRECTIONS FOR STUDENT SCIENCE LABORATORY WRITE-UPS

I. General Comments

A. Obtain a LABORATORY REPORT COVER SHEET from your instructor.

B. Type your Cover Sheet and report if possible. If not, use ink (never pencil) and write legibly.

C. Write in the third person. Do not use "I," "me," etc., in your report. Write complete sentences.

D. Be very thorough. Assume that the reader of your report knows absolutely nothing about the experiment you conducted.

E. When writing your lab report, follow the format given below.

II. The Lab Report Format

A. Cover Sheet

A very important section of this sheet deals with the purpose of your experiment. In the space provided, write one or two complete sentences stating the purpose of the investigation. What did you try to find out?

B. Introduction

1. State the problem you investigated. Be concise.

2. State why the problem is worthy of investigation.

C. Materials and methods

1. Organize this section of your report very carefully. Include all of the information another student would need to repeat your experiment, but do not include results and discussion here.

2. First, list all major items that you used as you conducted your experiment under the heading of "Materials." (See the FORMAT SUMMARY below.)

3. Then, summarize the procedure(s) you used in carrying out your experiment under the heading of "Methods." Please do not copy the procedure word for word, but rather give a general idea of what you did in a short paragraph.

D. Data and Observations

1. Use the metric system of measurement.

2. This section is not for the discussion and/or interpretation of data. Simply record what you observed and the data collected.

3. This section should include the results of your experiment in easily understood tables, graphs, and/or diagrams that are labeled, titled, and carefully arranged for ease of comparison.

4. Accompany tables, etc., with observations that are detailed and complete.

5. If calculations are needed, include them in this section.

E. Discussion

1. This is the most important portion of your report. Organize this section so that it is clearly understandable.
2. Analyze and interpret the data collected in the course of the experiment.
3. Is there more than one way to explain your results?
4. Discuss possible sources of experimental error.
5. Is further experimentation advisable?
6. As appropriate, do research to determine if your results were valid.
7. You may find it useful to re-read the "Purpose" section of your cover sheet before writing your discussion.

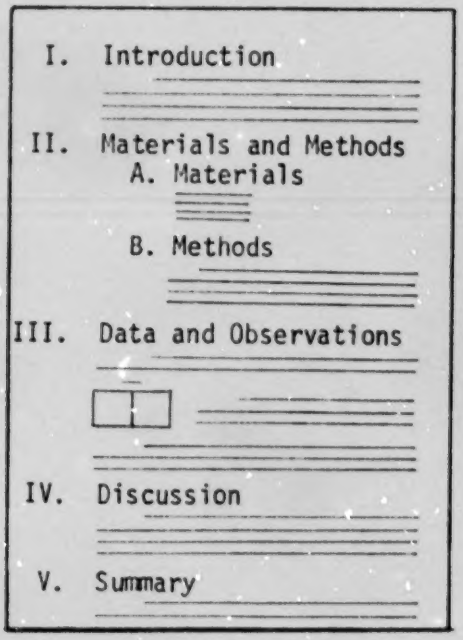
F. Summary

1. This section serves as a conclusion to your report.
2. In as few sentences as possible, summarize what you did and the conclusion you reached on the basis of the data collected.

III Format Summary

First Page: Cover Sheet (attached)

Remainder of your report:



LABORATORY REPORT COVER SHEET

TITLE:

PURPOSE:

DATE(S) PERFORMED:

DATE OF REPORT:

SUBMITTED BY:

INSTRUCTOR:

CLASS:

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